

Mortality from non-malignant diseases among women in the meat industry

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ABSTRACT A mortality follow up study was conducted among 7261 white female members in a local meatcutter's union in Baltimore, Maryland, between July 1949 and December 1980. The group was divided into four main job categories within the meat industry and a control group of non-meat workers belonging to the same union. Mortality in each of these subgroups was compared with that of white women in the United States general population through the determination of cause specific standardised mortality ratios. No increased risk of death from non-malignant causes was observed in any job category within the meat industry. Some caution should, however, be exercised in interpreting this finding, as few workers in chicken slaughtering plants died.

The trigger that sets in motion an interest in studying mortality in a given industry has often been that a particular exposure, or exposures, within the industry are conceived or suspected to be potentially harmful. This general pattern, however, does not seem to have applied to the meat industry. It has been known, for example, that workers wrapping and labelling meat develop an acute condition known as "meatwrapper's asthma" as the result of exposure to fumes emitted during this activity from the thermal decomposition of plastic.¹ This condition has been shown to be associated with upper and lower respiratory tract symptoms and a decrease in the forced expiratory volume in one second and forced vital capacity. Cattle and chickens at the time of slaughter are often found to be infected with viruses known to cause diseases of the blood and blood forming organs including leukaemia and lymphosarcoma in these animals.²⁻⁵ Workers in slaughterhouses and meatpacking plants are known to be at increased risk of zoonotic infections which include brucellosis, leptospirosis, Q-fever, and psittacosis.⁶ Other potentially harmful exposures in the industry include smoke during the smoking of meat, the nitrosamines formed during meat curing and storage, and certain tumour promoting antioxidants.⁷⁻¹⁰ Despite this array of potentially noxious exposures,

there has been little interest in their possible effects long after exposure has ceased. In particular, there has been no study on the mortality experience of women in the industry, although they constitute most of the workforce engaged in certain activities within the industry; commonly more than 90% of the meat-wrappers in retail food stores are women.¹¹ We conducted what was to our knowledge the first detailed mortality study of women in the industry and reported on the findings for death from cancers.¹² The present paper is a report on the non-cancer mortality pattern among the same study group.

Materials and methods

The study population was derived from among the membership of a local meatcutter's union in Baltimore, Maryland, and has been described in detail elsewhere.¹² They were followed up from July 1949 to December 1980 and the lost to follow up rate was 7.6%. Four main job categories in the industry were recognised within the union: (1) abattoir workers, (2) meatpacking plant workers (no slaughtering done), (3) workers in the meat department of retail food stores, and (4) workers in chicken slaughtering plants. A fifth category of workers outside the industry (control group) was also identified among the union membership. A total of 7261 white women who had been members of the union between 1949 and 1979 were identified, and since over 95% (6923) worked in only one job category throughout their membership, these

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Selected cause specific SMRs for white women in a local meatcutter's union in Baltimore, Maryland, by job category. (Figures in parentheses denote SMRs obtained when lost subjects were withdrawn at the time of loss)

Cause of death (ICD, 8th revision)	All groups (n = 7261) SMR	Abattoirs (n = 826) SMR	Meatpacking (n = 896) SMR	Grocery stores (n = 3622) SMR	Chicken plants (n = 4845) SMR	Non-meat (control) (n = 1095) SMR
All causes (ICD 001–998)	0.97 (1.10)* O = 535	0.83 (0.94) O = 87	1.17 (1.33)† O = 101	0.91 (0.97) O = 171	1.18 (1.26) O = 21	1.08 (1.37)‡ O = 132
Benign neoplasms (ICD 210–239)	2.17 (2.42)* O = 7	1.63 (1.83) O = 1	— O = 0	1.73 (1.84) O = 2	— O = 0	6.49‡ (8.17)‡ O = 4
Allergic, endocrine, metabolic, nutritional (ICD 240–279)	1.01 (1.14) O = 16	0.66 (0.74) O = 2	1.61 (1.84) O = 4	0.57 (0.60) O = 3	— O = 0	1.94 (2.41)* O = 7
Diabetes (ICD 250)	0.94 (1.06) O = 12	0.40 (0.45) O = 1	1.49 (1.71) O = 3	0.48 (0.51) O = 2	— O = 0	2.00 (2.47)* O = 6
All diseases of circulatory system (ICD 390–458)	0.98 (1.12) O = 203	0.97 (1.09) O = 40	0.99 (1.16) O = 32	0.98 (1.04) O = 61	1.29 (1.35) O = 7	1.10 (1.41)* O = 59
Arteriosclerotic heart disease (ICD 410–413)	1.08 (1.24)* O = 123	0.86 (0.98) O = 20	1.12 (1.32) O = 20	0.98 (1.03) O = 33	2.07 (2.15) O = 6	1.41* (1.80)‡ O = 42
All external causes of death (ICD 800–998)	0.75 (0.83) O = 38	0.64 (0.71) O = 5	1.34 (1.46) O = 10	0.53* (0.56) O = 11	0.39 (0.43) O = 1	0.91 (1.14) O = 8

O = Observed number of deaths.

* $p < 0.05$; † $p < 0.01$; ‡ $p < 0.001$.

6923 individuals were divided into their respective job categories and compared separately with the United States white female population through the estimation of cause specific standardised mortality ratios (SMR). A total of 535 deaths occurred among this group.

Results

Deaths among subjects lost to follow up are suspected to be negligible since an active search found no death certificates for them. Thus two estimates of cause specific SMRs for all the major organs and systems were calculated; one assuming all those lost to follow up were alive at the end of the study and the other, that those lost to follow up were withdrawn at the time of loss. Only SMRs statistically significant by either estimate in any job category are given in the table. The age distributions in the different job categories were virtually identical, hence the SMR for a given cause is directly comparable across job categories.

ALL UNION MEMBERS (white women)

The all causes SMR was 0.97 (assuming subjects lost to follow up were alive) and 1.10, $p < 0.05$ when subjects lost to follow up were withdrawn at the time of loss. The SMR for benign neoplasms of 2.17 (assuming subjects lost to follow up were alive) was not statistically significant; however, when lost subjects were withdrawn at the time of loss, the SMR was 2.42, $p < 0.05$. Similarly, the SMR for arteriosclerotic heart disease of 1.08 was not significant (assuming lost subjects were alive); when those lost were withdrawn at the time of loss, however, the SMR was 1.24, $p < 0.05$. No other cause of death was statistically significant by either estimate.

ABATTOIR WORKERS

The all causes SMRs of 0.83 and 0.94 by either estimate did not differ significantly from unity. Similarly, no cause specific SMR was statistically significant by either estimate. No deaths were observed for certain causes of death because of inadequate sample size in this group. Apart from ICD 680–709 (all diseases of skin and cellular tissue), however, a threefold excess risk would have resulted in at least one death observed for each of all the other causes of death.

MEATPACKING PLANT WORKERS

The all causes SMR for this group was 1.17 (not significant) when subjects lost to follow up were assumed alive at the end of the study. When lost subjects were withdrawn at the time of loss, however, the all causes SMR was 1.33, $p < 0.01$. No cause specific SMR was statistically significant by either estimate. No deaths were observed for certain causes of death. Apart from ICD 680–709, however, at most a fourfold risk was required to observe one death for any cause of death.

GROCERY STORES/SUPERMARKETS MEAT DEPARTMENT WORKERS

The SMRs for the all causes mortality by both estimates were 0.91 and 0.97, none of which was statistically significant. The only statistically significant SMR was that of 0.53, $p < 0.05$ for all external causes of death (ICD 800–998), assuming lost subjects were alive; the corresponding SMR of 0.56, with lost subjects withdrawn at the time of loss was not significant. The sample size in this group was adequate, and only for ICD 680–709 was an excess risk required to observe at least one death.

CHICKEN SLAUGHTERING PLANT WORKERS

There were only 21 deaths in this group and the estimates of the all causes SMR of 1.18 and 1.26 were not statistically significant. No cause specific SMR was statistically significant by either estimate. Except for the more common causes of death, however, the number of deaths in this group was inadequate to investigate cause specific mortality.

WORKERS IN NON-MEAT COMPANIES (control group)

The all causes SMR of 1.08 (assuming lost subjects were alive) was not significant; however, the corresponding SMR of 1.37 (lost subjects withdrawn at time of loss) was statistically significant, $p < 0.001$. The SMRs of 6.49 and 8.17 obtained by both estimates respectively for benign neoplasms (ICD 210–239) were highly significant, $p < 0.001$. The SMRs for ICD 240–279 (allergic, endocrine, metabolic, nutritional diseases) assuming lost subjects were alive, and with lost subjects withdrawn at the time of loss, were 1.94 and 2.41 respectively, the latter SMR being significant, $p < 0.05$. This excess was exclusively from diabetes (ICD 250); as can be seen, the respective SMRs for diabetes were 2.00 and 2.47, with the latter SMR again being significant, $p < 0.05$. The SMR for ICD 390–458 (all diseases of circulatory system) was 1.10 (not significant), assuming lost subjects were alive, and 1.41, $p < 0.05$, if lost subjects were withdrawn at the time of loss. Similarly, the respective SMRs for ICD 410–413 (arteriosclerotic heart disease and CHD) were 1.41, $p < 0.05$, and 1.80, $p < 0.001$. Apart from ICD 680–709, the sample size was large enough to observe at least one death if there was a threefold or higher risk of death.

Discussion

Total mortality among all the white women in this union was not significantly different from that among white women in the United States general population. On examination of the study group by the four main job categories within the meat industry, similar results were observed for all categories except meatpacking plant workers. Although among meatpacking plant workers the all causes SMR of 1.33 was statistically significant, $p < 0.01$ (when subjects lost to follow up were withdrawn at the time of loss), the all causes SMR of 1.37 among the control group of women in the same union who worked in non-meat companies (such as soft drinks manufacturing or oyster shucking) was also statistically significant, $p < 0.001$ (when subjects lost to follow up were withdrawn at the time of loss). If subjects who were lost to follow up were assumed to be alive at the end of the study, however, all causes SMRs of 1.17 and 1.08 which were not

significant were obtained for these two categories of workers. These results suggest that even if this excess mortality among meatpacking plant workers is real, the high background mortality may be contributory also. It is well known that mortality in the general population of Baltimore city from which over 60% of the study group was derived was much higher than that in the United States general population, SMR = 1.26 (A Gittelsohn, report to National Center for Health Statistics, 1981). It is to be noted that the only cause of death likely to be responsible for this apparent excess mortality among meatpacking workers would be mortality from cancers, as this was the only cause of death significantly raised in this group but not in the control group. We have previously reported in detail our findings on cancer mortality in this study group.¹²

No non-malignant cause of death was significantly raised in any of the job categories within the meat industry. This suggests that except for cancers the meat industry is not otherwise associated with unusual mortality among female workers. These results are not surprising. A comparatively clean working environment, engagement in less hazardous activities, stricter health requirements for employment, and good medical surveillance and care (factors that are known to prevail within the meat industry) would possibly explain these results for women.

The excess risk of death from benign neoplasms among the entire study group seemed to have originated exclusively from among the control group, SMR 6.49 or 8.17 ($p < 0.001$). A similar pattern was observed for arteriosclerotic heart disease. Thus it is reasonable to conclude that these diseases are not associated with the meat industry and that their excess among the control group probably reflects the background mortality. It is interesting that we had observed a similar risk for benign neoplasms among a similar control group of male workers in the same union.¹³ We do not have any explanation for the excess of diabetes in the control group except that it may be due to chance or reflect background rates. As already mentioned, this group of women comprised a heterogeneous group from several occupational groups outside the meat industry. The interpretation of our finding of an absence of excess risk from non-malignant causes of death among women in the meat industry should be tempered with caution, however, particularly with respect to workers in chicken slaughtering plants since the number of deaths in this group was too few to assess adequately cause specific risk.

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